REMARKS

In this amendment, claims 1-30 and 75-101 are pending. Claims 1, 2, 6, 7, 9-13, 16, 28, 30, 75, 78, 80-81, 84, 86, 87, 94, and 95 are amended. The amendments correct various informalities, add limitations from pending claims, and add clarifying language.

Applicants thank Examiner Leung for the meticulous examination accorded this application.

Claim Objections

All of the claims have been amended as suggested by the examiner except claim 89 which needs "that" to specify which flow path is being referred to. Claim 1 and dependent claims have been amended to consistently state a plurality of flow paths.

Rejection Under 35 U.S.C. §112, 2nd Paragraph

Claims 6, 7, 10-12, 30, 79-81, 86, 94, and 101 have been rejected under 35 U.S.C. §112, second paragraph.

Claims 6 and 7 are now amended to eliminate the problem with lack of antecedent basis. A manifold is not part of the flow path. In other words, separate manifolds can emanate from a single manifold.

Claim 10 is amended to remove the word "alternating."

Claim 30 is amended to eliminate the conflict with claim 29.

Claim 80 is amended is amended to omit mention of a catalyst in the first flow path.

Claim 81 is amended to specify a reaction in the second flow path.

Claims 86 and 94 are clear since a manifold is not part of the flow path. In other words, separate manifolds can emanate from a single manifold.

In view of the amendments and above remarks, withdrawal of the section 112 rejection is respectfully requested.

Rejection of claims 13-17, 21, 76, 85, 96, 99 and 100 under 35 U.S.C. 102(b) or 103(a) as being anticipated by or obvious over Bottcher et al.

As discussed on page 15 of the Office Action, an important issue for these claims is the meaning of "distillation." To the person of ordinary skill in the art, "distillation" is one type of separation. In other words, "distillation" is a subset of "chemical separation." Claim 13 has been amended to state only separation. The examiner has cited one definition of "distillation" from dictionary.com; however, this is not the best definition and it does not reflect the understanding of a person of ordinary skill. Dictionary.com does not contain the definition that would be understood by a person skilled in the art. The Condensed Chemical Dictionary (1977, van nostrand) defines distillation as "A separation process in which a liquid is converted to vapor then condensed to a liquid." Words in a patent are not given the definition that would be understood by a lay person, rather, "words in patent claims are given their ordinary meaning in the usage of the field of the invention." MPEP §2111.01.III quoting *Toro Co. v. White Consol. Indus., Inc.*, 199 F.3d 1295, 1299, 53 USPQ2d 1065, 1067 (Fed. Cir. 1999). Thus, interpreted by a person skilled in the art, "distillation" is a separation process. Bottcher et al. does not teach or

suggest a separation process. Accordingly, withdrawal of the rejection of claims 13-17, 21, 76, 85, 96, 99 and 100 is respectfully requested.

Rejection of claims 87-90, 92, and 93 under 35 U.S.C. 102(b) as being anticipated by or obvious over Bottcher et al.

On page 23 of the Office Action, the examiner has stated that "the openings 7 that define the flow paths 1 are shaped in a linear or oblong fashion, and therefore, the openings define a flow path that extends in a direction substantially perpendicular to shim thickness." It is respectfully submitted that this rejection is based on an overly semantic (and incorrect interpretation of the term "flow path" versus "flow." *Flow* through the openings 7 is substantially parallel (not substantially perpendicular) to shim thickness. To expedite prosecution, claim 87 has been amended to further recite that flow in the section is "substantially perpendicular to shim thickness."

Rejection as Obvious Over Bottcher et al. ('818) in view of Yamashita et al.

Claims 1-3, 6-9, 75, 78, 79, 86, and 95 have been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818) in view of Yamashita et al.

In Bottcher, heat exchange is enhanced by turbulent flow in the cross-flow channels 4. Thus, the person skilled in the art would not be motivated to modify Bottcher's devices by incorporating the features of Yamashita. Additionally, claim 1, as now amended, recites plural flow paths parallel to sheet thickness; this feature is not taught or suggested by Yamashita or the combination of Bottcher and Yamashita.

Claim 75 is additionally patentable because it recites that the shape of the aperture comprises waves or irregular shapes that create a boundary layer separation. This is not a mere arbitrary shape change; it provides an advantage that is not recognized in the prior art. Specifically, the wavy (see Fig. 4c) or irregular apertures create a boundary layer separation and improve heat transfer.

Rejection as Obvious Over Bottcher et al. ('818) in view of Yamashita et al. and further in view of Bottcher et al. (US 5,212,004)

Claim 4 has been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818) in view of Yamashita et al. and further in view of Bottcher et al. (US 5,212,004).

This rejection is traversed for the reasons discussed above with respect to claim 1. Additionally, there is not a proper motivation for combining the design of the '004 patent with the design of the '818 patent.

Rejection as Obvious Over Bottcher et al. ('818)

Claims 10 and 101 have been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818). This rejection is respectfully traversed.

Claim 10 requires flow through the first and second flow paths to be "substantially parallel to shim thickness." This is not the case in Bottcher in which flow through flow spaces 4 is substantially perpendicular to sheet thickness. In other words, Bottcher is a cross-flow device,

it is not a parallel flow device. Accordingly, withdrawal of this rejection is respectfully requested.

Rejection as Obvious Over Bottcher in view of Yamashita et al.

Claims 11 and 12 have been rejected under 35 USC §103(a) as obvious over Bottcher (US 5,657,818) in view of Yamashita et al.

This rejection is traversed for the reasons discussed above with reference to claim 10.

Rejection as Obvious Over Bottcher et al. ('818) in view of Bottcher et al. ('004)

Claims 18-20 and 22 have been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818) in view of Bottcher et al. (US 5,212,004).

This rejection is traversed for the reasons discussed above for claim 13. Additionally, all of these claims depend from claim 16, and claim 16 is now amended to recite adjacent "ortho" style channels comprising a second fluid. Bottcher does not teach or suggest this feature since Bottcher is cross-flow.

Rejection as Obvious Over Bottcher et al. ('818) in view of Haswell et al.

Claims 24-26, 77 and 97 have been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818) in view of Haswell et al. This rejection is respectfully traversed.

As explained in Applicants' specification, the invention represents a radical departure from previously presented configuration for microchannel technology. Prior microchannel devices (such as those of Haswell) were oriented such that the microchannels ran along the

length of the shim (or plate). Microchannels devices having the conventional orientation could be made by etching microchannels into a plate or wafer. This was well developed technology from the electronics industry. Alternatively, channels could be made by stamping; in this fashion, the channel height would be defined by the thickness of the shim from which the microchannels were stamped. No one had thought to make process microchannels in the direction parallel to shim thickness. Furthermore, no one had recognized any advantage from this orientation, for example, no one had recognized any advantage for constraining high interstream pressure differentials within microchannels using this configuration.

The invention of claim 24 is not obvious over the prior art because the prior art does not provide a motivation to construct microchannel devices in the "ortho" direction; nor does the prior art provide an enabling teaching for microchannels constructed in this fashion. "The consistent criterion for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable expectation of success, viewed in light of the prior art." *In re Dow Chemical Co.*, 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1988), cited in MPEP 2144.08. In this case, the prior art does not suggest the desirability of microchannel devices constructed in the "ortho" direction, nor does it provide an enabling description for ways to construct such devices. Accordingly, the invention of claim 24 is not prima facie obvious over the cited references.

Even if the claimed invention were *prima facie* obvious, the surprising and superior results for operation at high pressure would establish the nonobviousness of the claimed invention. On page 27 of the Office Action, the examiner has stated that the Bottcher device

would be inherently capable of withstanding high pressure differentials. This is not true. Force is equal to pressure times area (F = P x A) (see, e.g., definition of pressure in Wikipedia). Thus, in a large area, laminated device such as Bottcher, the force on each plate would be much larger and, at high pressures, Bottcher's device would be prone to leakage and failure. Thus, the claimed invention provides superior structural integrity at high pressure and this superior high pressure performance at microchannel dimensions is not suggested in the prior art.

Furthermore, the Bottcher reference is not appropriate for an obviousness-type rejection because it is non-analogous art. On page 27 of the Office Action, the examiner has stated that the Bottcher device would have been considered analogous art because it is concerned with the problem of achieving improved control of heat transfer. The standard for analogous art is set forth in MPEP 2141.01(a) ("In order to rely on a reference as a basis for rejection of an applicant's invention, the invention must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned.") See also *In re Clay*, 23 USPQ2d 1058 (Fed. Cir. 1992). In this case, the particular problem that concerned the inventor was the operation of a microchannel device at high pressure. The problem was not improved control of heat transfer; excellent heat transfer can be obtained in microchannel apparatus with flow paths in the conventional (non-ortho) orientation. The Bottcher device was not in the same field of the invention of claim 24 (microchannel apparatus), nor was it concerned with "the particular problem with which the inventor was concerned" (high pressure operation). Therefore, the Bottcher reference is not analogous art and cannot be considered in a section 103 rejection.

Accordingly, withdrawal of this rejection is respectfully requested.

Rejection as Obvious Over Bottcher et al. ('818) in view of Symonds

Claim 91 has been rejected under 35 USC §103(a) as obvious over Bottcher et al. ('818) in view of Symonds.

As discussed above with relation to claim 87, neither of the cited references describe a semi-ortho design. Accordingly, claim 91 is nonobvious over the Bottcher and Symonds references.

Allowable Subject Matter

Claim 30 is now amended.

Claim 84 is now amended to incorporate all of the limitations of the base claim and any intervening claims.

Conclusion

If the Examiner has any questions or would like to speak to Applicants' representative, the Examiner is encouraged to call Applicants' attorney at the number provided below.

Respectfully submitted,

Date: __28 September 2008

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